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Gamma-gamma directional correlations of the 552-134 keV cascade in Re^{187}

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The level structure of Re^{187} is well established (Way *et al* 1965). The 552-134 keV gamma-gamma angular correlation was measured by several authors in the past (Arns *et al* 1960, Gallagher *et al* 1960, Michaelis 1963. Gupta *et al* 1966, Klementovskeya *et al* 1959). Arns *et al* reported a very high positive anisotropy ($A_2 = 0.316 \pm 0.018$, $A_4 = -0.086 \pm 0.027$) whereas Gallagher *et al* found the correlation to be isotropic within 1%. Michaelis and Gupta *et al* observed small negative anisotropy for this correlation, whereas, Klimentovskeya *et al* observed small positive anisotropy. In view of the above discrepancies it was felt worthwhile to remeasure the 552-134 keV gamma-gamma angular correlation in Re^{187}.

The directional correlation of the above cascade is measured with a conventional slow-fast coincidence scintillation assembly described elsewhere (Narasimha Raju *et al* 1968). The system is checked by measuring the 1.17-1 33 MeV gamma-gamma angular correlation in Ni^{60}. The present measurements were done with an effective coincidence resolution of 20 ns. The angular correlation data were collected at three angles 90°, 135° and 180° and were corrected for the short life of W^{187} and chance coincidences. The pooled up counts at the three angles were normalized and the data fitted to the standard polynomial

$$W(\theta) = 1 + A_2 P_2(\cos\theta) + A_4 P_4(\cos\theta)$$

by the method of least squares (Rose 1953). The angular correlation function after correcting for the geometry of both the detectors is found to be

$$W(\theta) = 1 - (0.028 \pm 0.015) P_2(\cos\theta) + (0\ 012 \pm 0.017) P_4(\cos\theta)$$

This result is in fairly good agreement with that obtained by Michaelis and Gupta *et al* and differs considerably from the values of Gallagher *et al*, Klementovskeya *et al* and Arns *et al*. The experimental values of A_2 and A_4 coefficients of the earlier authors together with the values of the present work are given in table 1.

The present angular correlation function is consistent with the spin assignment 5/2 to the 686 keV level and with the quadrupole content of the 552 keV radiation ($Q_{552} \leqslant 0.03$) reported by Michaelis and Gupta *et al*.

TABLE 1. The values of the A_2 and A_4 coefficients of the 552-134 keV directional correlation

References	A_2	A_4
Arns *et al* (1960)	$+0.316\pm0.018$	-0.086 ± 0.027
Gallagher *et al* (1960)	Isotropic within 1%	
Michaelis (1963)	$-0\ 034\pm0.017$	$-0.007\pm0\ 030$
Klimentovskeya *et al* (1959)	Small positive anisotropy	
Gupta *et al* (1966)	$-0\ 0235\pm0\ 0132$	$+0.0299\pm0.0235$
Present work	$-0\ 028\ \pm0.015$	$0\ 012\ \pm0\ 017$

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